PATENT SPECIFICATION

DRAWINGS ATTACHED

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1,174,969

1,174,969

Date of Application and filing Complete Specification: 20 Oct., 1967.

No. 47905/67.

Complete Specification Published: 17 Dec., 1969.

Index at acceptance: —**H2 A**(2K1, 2K7, 4F2, 13D, 16P); **F1 G**(2, 11); **F1 TB9A**

International Classification:—**H 02 k 7/18**

COMPLETE SPECIFICATION

Gas Turbine Engine Provided with an Alternator

We, ROLLS-ROYCE LIMITED, a British company of Nightingale Road, Derby, Derbyshire, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention concerns a gas turbine engine which is provided with an alternator.

According to the present invention, there is provided gas turbine engine comprising an alternator, a rotary armature structure of the alternator being carried by a bladed rotor structure of the engine, a stationary field structure of the alternator being carried by a stationary bladed structure of the engine.

The term "armature" as used herein means that part of the alternator in which the output voltage is produced.

Preferably the bladed rotor structure is a compressor rotor structure and the stationary bladed structure is a compressor stator structure.

The engine may comprise at its upstream end an intake bullet, the bullet being provided with anti-icing heating element to receive electrical power from the alternator.

The intake bullet may rotate with the compressor rotor structure at the same speed and in the same angular sense.

The rotary armature structure may comprise a polyphase and preferably a two-phase armature structure.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:—

Figure 1 is a diagrammatic view, partly in section, of a gas turbine engine in accordance with the present invention,

Figure 2 is a broken-away view, partly in section and on a larger scale, of a part of the gas turbine engine shown in Figure 1,

Figure 3 is a broken-away sectional view showing part of the structure of Figure 2 on a yet larger scale, and

Figure 4 is a broken-away sectional view looking in the direction of the arrow 4 of Figure 3.

In Figure 1 there is shown a gas turbine by-pass engine 10 having an engine casing 11 within which there are mounted in flow series a low pressure compressor 12, a high presure compressor 13, combustion equipment 14, a high pressure turbine 15 and a low pressure turbine 16, the turbine exhaust gases being directed to atmosphere through an exhaust duct 17.

As best seen in Figure 2, the low pressure compressor 12, which is drivingly connected to the low pressure turbine 16 by way of a shaft 20, is provided with a rotor structure which includes a rotor first stage 21. The low pressure compressor 12 also has a stator structure which includes a stator first stage 22; the stator first stage 22 carrying radially inwardly thereof a bearing 23 within which the shaft 20 is rotatably mounted.

The engine 10 has an intake bullet 24 which is connected to the rotor first stage 21 so as to rotate therewith. Since the intake bullet 24 is liable in certain conditions to ice up, it is provided with anti-icing heating elements 25 which collectively constitute a heating load for an alternator generally indicated at 26. The heating elements 25 may, for example, be embedded in a synthetic resin matrix (not shown).

The alternator 26 comprises a rotary armature structure 27, which is carried by and thus driven by the rotor first stage 21, and a stationary field structure 28, the rotary armature structure 27 being arranged concentrically about the field structure 28. The field

structure 28 is fixed to the first stator stage 22 and is thus itself stationary.

The rotary armature structure 27 comprises a laminated annular core 31 which is provided with armature coils 32 which are arranged as a polyphase winding, a two-phase winding being preferably employed since it is considered most convenient for distributing the load. The laminated annular core 31 is provided with a plurality (e.g. 192) of equally spaced slots 33 for receiving the conductors of the armature coils 32. These conductors are preferably aluminium conductors which, although they will inevitably be of larger cross-section than equivalent copper conductors, are less heavy and, more importantly, considerably reduce the centrifugal loading to which the laminated annular core 31 is otherwise subject.

The laminated annular core 31 of the rotary armature structure 27 is carried by a flange 34 of the rotor first stage 21, the flange 34 being disposed radially inwardly of the platforms 35 of the blades of the rotor first stage.

The stationary field structure 28 is a heteropolar system having, for example, twenty four pieces 36 provided on an annular member 37, the annular member 37 being carried by a flange 38 which forms part of the stator first stage 22 and is disposed adjacent to the bearing 23. The pole pieces 36 are retained in the annular member 37 by means of wedges 39.

Since the rotary armature structure 27 rotates, centrifugal loads will help to bed the armature coils 32 in the slots 33, four such slots being provided for each of the pole pieces 36.

Each of the pole pieces 36 has a field coil 40. As will be appreciated since the field structure 28 is stationary, it is not necessary to provide slip rings between the field coils 40 and a stationary source of electrical energy (not shown). Since, for good mechanical clearance, a fairly large air gap, e.g. of 0.030" should be used, the field coils 40 need to be of copper in order to provide the ampere turns required in the space available.

The heating load constituted by the heating elements 25 is connected (by means not shown) in an electrical circuit which includes the armature coils 32. As will be appreciated, since the load and the rotary armature structure 27 rotate in unison and in the same angular sense, it is not necessary to provide slip rings between them.

WHAT WE CLAIM IS:—

1. A gas turbine engine comprising an alternator, a rotary armature structure of the alternator being carried by a bladed rotor structure of the engine, a stationary field structure of the alternator being carried by a stationary bladed structure of the engine.

2. A gas turbine engine wherein the bladed rotor structure is a compressor rotor structure and the stationary bladed structure is a compressor stator structure.

3. A gas turbine engine as claimed in claim 1 or 2, the engine comprising at its upstream end an intake bullet, the bullet being provided with anti-icing heating element adapted to receive electrical power from the alternator.

4. A gas turbine engine as claimed in claim 3 wherein the intake bullet rotates with the compressor rotor structure at the same speed and in the same angular sense.

5. A gas turbine engine claimed in any preceding claim in which the rotary armature structure comprises a polyphase armature structure.

6. A gas turbine engine as claimed in claim 5 in which the polyphase armature structure is a two-phase armature structure.

7. A gas turbine engine substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa. 1969.
Published by the Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig.1.

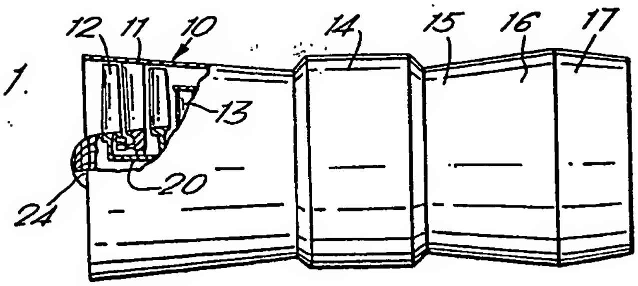


Fig.3.

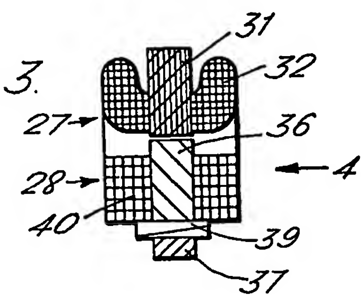
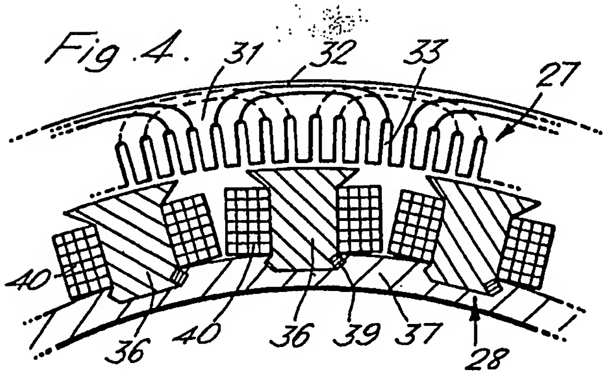


Fig.4.



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Sheet 2

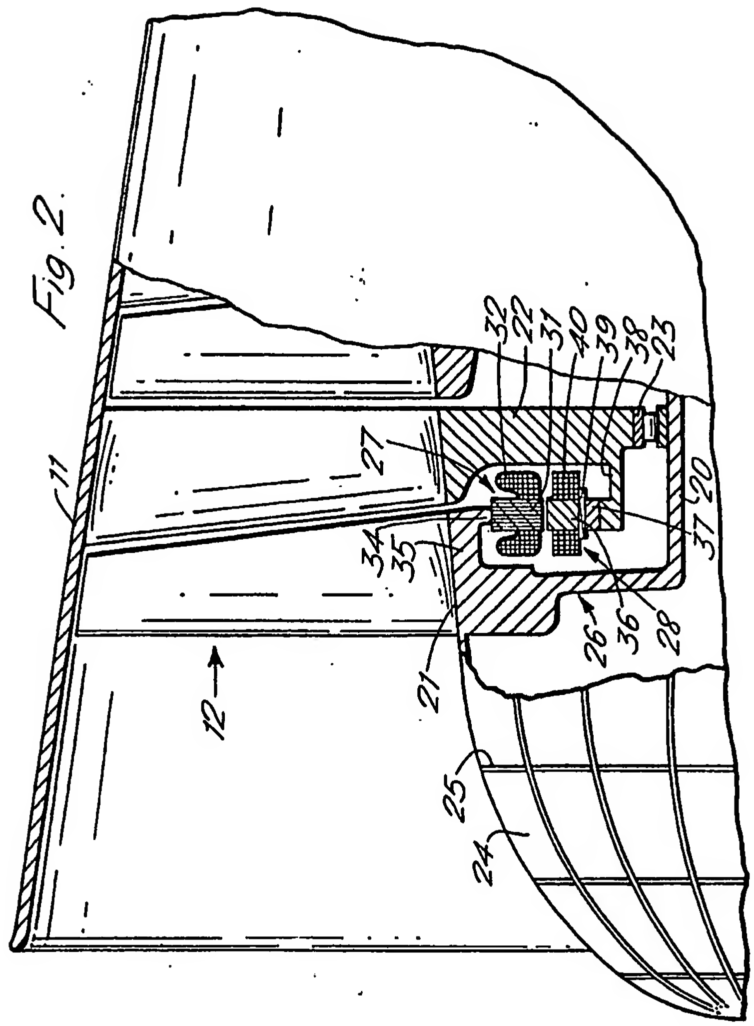

Fig. 2.